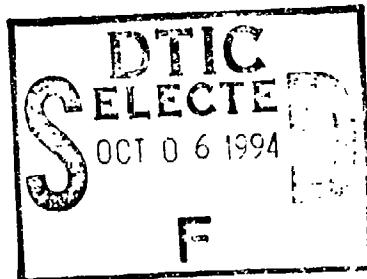
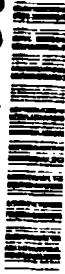


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AN ANALYSIS OF ISO 9000'S APPLICABILITY  
TO  
WORLDWIDE WAREHOUSE QUALITY ASSURANCE

THESIS

Anthony T. Dyess, Captain, USAF  
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TO WORLDWIDE WAREHOUSE QUALITY ASSURANCE

THESIS

Presented to the Faculty of the School of Logistics and Acquisition Management  
of the Air Force Institute of Technology  
Air University  
In Partial Fulfillment of the  
Requirements for the Degree of  
Master of Science in Logistics Management

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September 1994

Approved for public release; distribution unlimited

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Terry Dyess and Henry Stish

## Table of Contents

	Page
Acknowledgments.....	ii
List of Figures.....	v
List of Tables.....	vi
Abstract .....	vii
I. Introduction.....	1
General Issue.....	1
Scope.....	3
Problem Statement .....	4
Research Objectives.....	4
Research Questions .....	4
Definition of Terms.....	5
Overview of Thesis .....	5
II. Literature Review .....	6
Chapter Overview .....	6
FMS Excess Inventory Accumulation.....	6
The Worldwide Warehouse .....	9
Supplier Certification.....	12
ISO 9000.....	14
NATO's SHARE Initiative.....	22
Conclusion .....	23
III. Methodology .....	25
Chapter Overview .....	25
Research Design .....	25
Research Parameters .....	26
Data Collection .....	28
Analysis.....	30
Conclusion .....	30
IV. Research Findings .....	31
Chapter Overview .....	31
Research Objectives .....	31

	Page
Objective One .....	31
Objective Two .....	34
Objective Three .....	38
Conclusion .....	41
<b>V. Conclusions and Recommendations.....</b>	<b>42</b>
<b>Chapter Overview .....</b>	<b>42</b>
<b>Summary of Research.....</b>	<b>42</b>
<b>Conclusions .....</b>	<b>43</b>
<b>Recommendations .....</b>	<b>49</b>
<b>Future Research .....</b>	<b>50</b>
<b>Appendix A: Glossary of Terms.....</b>	<b>51</b>
<b>Appendix B: List of Interviewed Personnel.....</b>	<b>54</b>
<b>Appendix C: List of Interview Questions.....</b>	<b>56</b>
<b>Bibliography.....</b>	<b>58</b>
<b>Vitae .....</b>	<b>61</b>

## List of Figures

Figure	Page
1. Worldwide Warehouse Flow Diagram.....	10

List of Tables

Table	Page
1. ISO 9000 Components .....	14
2. ISO 9000 Audited Quality Elements.....	20

Abstract

This study examines the applicability of ISO 9000, a worldwide quality standard, to the quality assurance procedures being built into a new Foreign Military Sales (FMS) program. This new program, the Worldwide Warehouse, is an Air Force Security Assistance Center (AFSAC) attempt to assist FMS customers in reducing excess materiel inventories. Areas of investigation include ISO 9000's international acceptance, its ability to ensure quality products, and a case study of SHARE, a NATO initiative which employs ISO 9000 in quality assurance and is dramatically similar to the Worldwide Warehouse. The researchers conduct an exploratory study using a literature review and personal interviews with individuals possessing special insight in the subject areas. It is concluded that achieving ISO 9000 certification is very difficult, maybe even impossible for some Worldwide Warehouse customers. This difficulty often results in years of effort. Going further, the fact that the benefits to be gained by the Worldwide Warehouse are minimal even if successful implementation were achieved, leads to the conclusion that the value added does not justify ISO 9000 as the standard for Worldwide Warehouse quality assurance.

AN ANALYSIS OF ISO 9000'S APPLICABILITY  
TO WORLDWIDE WAREHOUSE QUALITY ASSURANCE

I. Introduction

General Issue

For years, the United States has been a world sales leader in the military assets arena. Indicative of the success of these sales, countries in every region of the world continue to exhibit preferences for American equipment. Along with the success that comes from selling these assets, however, American planners have recently noted a growing problem among customers: excessive spare parts inventories. Created by factors such as overforecasting and obsolescence, such inventories have become a major dilemma to American allies. In addition to taking up costly warehouse space, these excesses tie up billions of dollars in unusable assets, depriving customers of cash better spent in other areas.

To combat this excess inventory problem, the Air Force Security Assistance Center (AFSAC) recently proposed a new program known as the Worldwide Warehouse. The idea behind the program is a simple one. By cataloguing the excesses of its customers into a centralized database, the Worldwide Warehouse will act as a broker between those governments hoping to sell their excesses and those having a need for the same items.

Such a program is likely to be quite popular among selling governments. Participating nations, after all, will not only receive exposure to a potentially vast marketplace, but also the advantages of simplification and increased speed over current procedures for selling excess inventories. This will allow them to more easily recover much of their investment from assets now indefinitely banished to the warehouse.

Ironically, however, the program's popularity may also provoke some concerns among buyers. Each country, to a large extent, has its own procedures for storing and maintaining its materiel. Owing to this non-standardization, parts considered serviceable in one country may be considered rubbish in another. With the myriad of countries expected to participate as suppliers, then, ensuring high quality parts to end users will likely prove to be a difficult task.

One way AFSAC has proposed tackling this quality issue is through the implementation of a rapidly growing process certification standard called ISO 9000. In theory, once a nation's storage and repair agencies become process certified they can be relied upon to generate parts of unquestioned quality. Since the alternative to certifying the Air Force repair depots of selling governments is a costly inspection process, AFSAC and subscribing governments potentially have much to gain from the ISO 9000 approach. Indeed, if supplier certification can guarantee quality at the source, receiving inspections might be eliminated altogether.

Because ISO 9000 was designed for use in the business world, however, questions remain about its suitability for Foreign Military Sales (FMS) purposes. Unlike the long-term buyer-seller relationships common in the business world, for example, many nations may only infrequently use the Worldwide Warehouse, perhaps rendering certification economically undesirable. In addition, ISO 9000 is plagued with a variety of standardization difficulties, ranging from a lack of standard interpretation and accreditation procedures to problems with mutual recognition for accreditors. Finally, doubts remain about whether or not ISO 9000 can even stand alone as ensuring quality in and of itself.

### Scope

This thesis explores the current knowledge and research of ISO 9000, and assesses its applicability to the Worldwide Warehouse. To assist in this assessment, a close look will be made of a comparable program, the Stock Holding and Asset Requirements Exchange (SHARE). Although it is actually a program of the North Atlantic Treaty Organization (NATO), SHARE has remarkably similar objectives and quality concerns when compared to the Worldwide Warehouse.

Since the Worldwide Warehouse is still in its infancy, its policies are still evolving. Therefore, all descriptions of how this program will work are based on the projections of AFSAC as of January 1994. Although the mechanics of this program are rapidly changing, this should not impact the quality control issues being investigated in this thesis.

### Problem Statement

Since the quality issues discussed above must be addressed if the Worldwide Warehouse program is to become viable, it is crucial that the doubts about ISO 9000 be resolved. Therefore, the specific problem addressed by this thesis is to find the applicability of ISO 9000 to the quality assurance procedures of the Worldwide Warehouse.

### Research Objectives

To accomplish this task, this thesis pursues three different objectives: (1) assess the ramifications of placing ISO 9000 at the core of a quality program; (2) investigate whether ISO 9000 can be implemented to ensure high quality products flowing through the Worldwide Warehouse; and (3) conduct a case study of the procedures SHARE employs in its implementation of ISO 9000.

### Research Questions

In consideration of the three previously mentioned objectives, a total of six different research questions have been identified. Paired with the numeral of their associated research objective, these questions are:

- 1a. Is ISO 9000 interpreted identically by all agencies worldwide?
- 1b. Are ISO 9000 accreditation procedures standardized?
- 1c. Do all nations recognize the certifications of accrediting agencies outside their borders?
- 2a. Can ISO certification ensure quality in and of itself?

- 3a. Does SHARE sufficiently resemble the Worldwide Warehouse such that useful comparisons might be made?
- 3b. How is ISO 9000 employed in SHARE's current quality assurance procedures?

#### Definition of Terms

A glossary of terms used in this thesis may be found in Appendix A. Unless otherwise noted, all definitions were taken from the FMS Glossary of Terms prepared by AFSAC's policy branch, XMXB.

#### Overview of Thesis

This first chapter introduced AFSAC's general concerns regarding quality for its Worldwide Warehouse program as it might be applied by ISO 9000. A specific problem statement, research questions, scope of the research, and definition of terms were also addressed.

The remainder of this thesis consists of a review of literature in Chapter Two, a methodology explanation and description in Chapter Three, a report on our research findings in Chapter Four, and an analysis of those findings with our conclusions and recommendations in Chapter Five.

## II. Literature Review

### Chapter Overview

This chapter presents information obtained through a search for current knowledge pertaining to FMS excess inventory build-up, AFSAC's Worldwide Warehouse, supplier certification, ISO 9000, and NATO's SHARE program. This information lays the foundation necessary for discovering the answers to the questions posed in the previous chapter.

### FMS Excess Inventory Accumulation

During the past fifty years, the United States has become a major world player in arms exports. In recent years America's volume of arms sales worldwide has been unmatched by any other nation (Cole and Lubman, 1994:A1). Several reasons exist for this surge in sales: US sales can strengthen ties with its allies, promote regional stability, and in the absence of such stability, can help provide victory for America's interests. As William Clements, Deputy Secretary of Defense, stated in 1975, "If we achieve regional stability in crucial areas of the world without the need for direct intervention by American forces, then our security assistance programs have been rewarded" (Cullin, 1985:II-9).

While the recent surge in US Foreign Military Sales may suggest customers have been for the most part quite pleased with the terms of previous sales, many buyers now report the common problem of possessing an excessive inventory of spare parts for their systems. Several factors are at the root of these excesses.

Typically, overforecasting and overzealous buying are the chief culprits. In such instances, planners frequently have recommended purchases in excess of actual requirements in order to reduce the risk of a potentially embarrassing shortage of spare parts. Excess materiel may also result in cases where modifications or new equipment render the spare parts obsolete.

Whatever the reasons for this excessive spare parts inventory, its quantities worldwide have now reached truly staggering levels. Unfortunately, because nations typically are reluctant to release their figures on the amount of excess materiel held, exact quantities are unknown. However, based on the tentative indications of its customers, AFSAC has opined that the value of excess materiel worldwide could now well exceed \$5 billion (Brusky, 1994).

Owing to the existence of so much excess inventory, the ramifications to US FMS customers are certainly significant. Indeed, according to Tersine, "excess inventory is a negative asset that is dead weight. It uses valuable storage space, depletes working capital, eliminates other opportunities, inflates assets, and reduces return on investment" (Tersine, 1994:293).

Foreign governments, however, are not the only parties hurt by such excessive parts inventories: the United States itself is also harmed by these surpluses. Lack of an acceptable way for FMS customers to transfer their excesses has arguably tarnished the image of American support for their customers. This often results in a weakened allegiance to the US. Particularly in the time period after an FMS sale is made, US influence upon its FMS

customer is not as great as it otherwise might be if post-sale support were improved (Brusky, 1994).

Clearly, a mechanism for the transfer of previously bought US FMS materiel would be quite helpful for purchasers. Currently, two such instruments, Third Country Transfers and the FMS Excess Materiel Return (FEMR) program are available to prior customers, but because of a myriad of problems these programs are not judged as satisfactory by either AFSAC or its customers (Brusky, 1994).

The Third Country Transfer instrument originates under the terms of all US sales agreements. These terms require the buyer to gain the consent of the US State Department before transferring title of the purchased equipment to another nation. This vehicle for disposing of excess materiel suffers from two deficiencies. First is the requirement to obtain the signature of an Under Secretary of State. This requirement alone is indicative of the bureaucratic nightmare likely to be experienced by any nation attempting to execute such a transfer. Second is the lack of US government assistance in brokering these transfers. Even if the bureaucracy were removed, the inefficiency, and often inability, of a nation to locate buyers for their excesses or sellers for the shortages makes this Third Country Transfer option impractical.

The FEMR program also proves impractical, but for different reasons. Managed by the Air Force Materiel Command, this program allows the FMS customer to return excess materiel originally acquired through an FMS program

to fill a specific USAF requirement (AFM 67-1, VOL IX:14-9). Unfortunately for the FMS customer, the USAF will not accept such returned materiel unless it is offered precisely when required for purchase by the item manager. Since most item managers are typically in such a "buy" position only a few weeks each year, this requirement seriously impedes FEMR's usefulness. To make matters worse, the item manager keeps no record of prospective return items. Therefore, if a submitted return item is not accepted immediately when offered, the offer is discarded and never reconsidered by the item manager, even when he reaches his next "buy" position.

#### The Worldwide Warehouse

To rectify its customers' excess inventory problems, AFSAC has proposed an alternative program, the Worldwide Warehouse. This program will allow for quick and easy redistribution of excess inventory among FMS customers. Using the Worldwide Warehouse, AFSAC hopes to 1) "List and redistribute all of our customers' serviceable excess military equipment which had been acquired via the US government's security assistance program," and 2) "Provide equitable, economical, and rapid support to both purchasers and offerors" (Brusky, 1994). Presently, the goal for completing any transaction is less than 15 days from the time an order is placed, a dramatic improvement over current procedures.

Conceptually, the Worldwide Warehouse will function as shown in Figure 1. As depicted in Step 1 on this diagram, offering nations will first provide AFSAC with the current listings of their excess inventories. To help overcome foreign

reservations about providing such data, AFSAC has agreed to preserve the anonymity of all data listed. Pooling these listings for all participating FMS customers, AFSAC next will compile them into a centralized database. Direct access to this database will be available only to AFSAC.

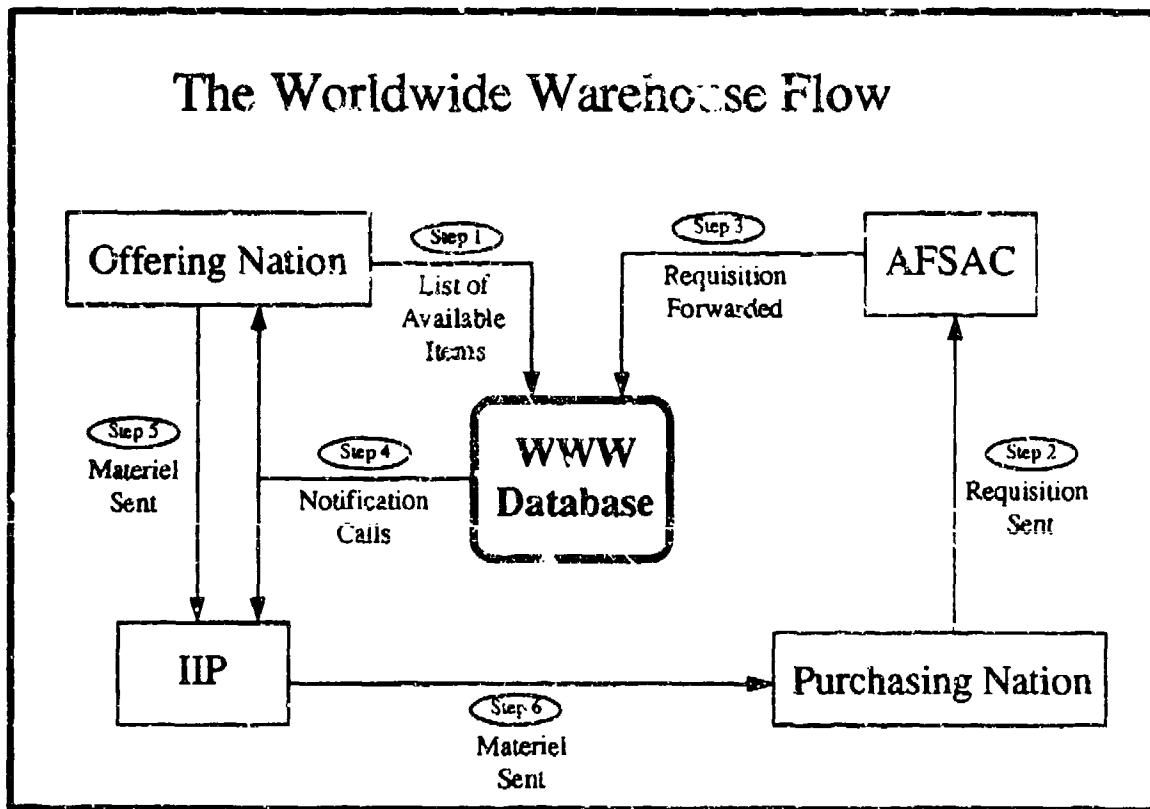


Figure 1. Worldwide Warehouse Flow Diagram

Despite the lack of information concerning the exact quantities of items eligible for this database, a fair estimate of the percentage of repairable versus consumable items can be determined. Because the Worldwide Warehouse will handle only items previously sold through the US FMS program, one can assume that the eligible inventories will mirror those which now are or previously

have been maintained by the US Air Force. Based on this assumption, then, it is estimated that the reparables versus consumables percentages are five and 95 percent, respectively (Christensen and Ewan, 1985:2). As will be explained in Chapter Five, such an estimate is important because of the varying degrees of effort required to guarantee high quality between these two types of items.

With the stock of materiel now identified, AFSAC will then be in a position to respond to customer requirements. From the perspective of the buying nation, no change in the purchasing process will be evident. Therefore, orders to AFSAC will arrive using the same procedures as have been used in the past. Step 2 in Figure 1 indicates this action.

Once an order is received, AFSAC will first check with AFMC to see whether or not the item will be available for shipment within a specified period (acceptable period is still to be negotiated within AFMC). If it will not, AFSAC will search the Worldwide Warehouse database for the same part. If a parts match can be found between offering and purchasing nations, the requisition is granted to the Worldwide Warehouse, as identified in Step 3. If no match is made, AFMC will fill the requisition using current procedures.

Once the requisition is passed to the Worldwide Warehouse, a call (Step 4) is immediately made to the offering nation indicating that a buyer has been found for their part(s). Instructions will then be given to ship the materiel immediately to an In-transit Inspection Point (IIP). This shipment will be made at the offeror's expense, and is depicted in Step 5.

The most important role played by the IIP is the removal of all national markings for the purpose of maintaining anonymity throughout the system. Such action is essential in order to avoid political confrontations which might arise due to the transfer of parts between political adversaries. This would alleviate, for example, the inability to transfer parts between Israel and Saudi Arabia.

Owing to this fact that an IIP is politically required, it is the logical place for materiel to undergo a quality control inspection. AFSAC is currently working on the procedure for such inspections. The options range from only a cursory visual inspection to a full functional inspection for each item shipped. As identified in the first chapter of this thesis, AFSAC also hopes to eliminate quality control inspections altogether if a certification process known as ISO 9000 can successfully be introduced. In any event, once the item is approved at the IIP, it is shipped directly to the purchaser. This final step is indicated in Step 6 of

Figure 1.

Seemingly, the Worldwide Warehouse offers an alternative which could better ensure the strength of the defense forces of US allies. However, until quality can be assured to buyers, whether through inspection or a supplier certification process such as ISO 9000, the feasibility of this program cannot be secured.

#### Supplier Certification

A theme resounding throughout the quality control community is supplier certification. Within the business community the adversarial role between

purchaser and supplier which has so often been played out in the past is now giving way to long-term alliances and cooperation (Lockhart and Etkin, 1993:66). The trend is proving to be a win-win situation. Inman and Hubler contend that "the ultimate goal of supplier certification is quality at the source". . . so that "customer-receiving inspection may be utilized with decreasing frequency up to the point where it is eliminated altogether" (1992:11).

Recently, *Purchasing* magazine conducted a survey which concluded that supplier rating programs were present in almost two-thirds of the major manufacturing firms in America. Evidencing the success of such programs, more than half of all respondents noted their programs acted to improve quality, reduce costs, and end inspections (Evans and Lindsay, 1993:218).

Purchasers must realize, however, that supplier certification does not mean that defective products will not be received. This type program demands the commitment of both sides. "Designing and implementing a vendor certification program is an ambitious undertaking. The certification program requires a significant amount of patience and hard work, not only to design and implement, but to maintain once it is functioning," say Lockhart and Etkin (1993:65). They conclude that the benefits of "reduced inventories, less waste, shorter lead times, improved supplier relations, lower costs, better quality," . . . are normally worth the effort (1993:69).

## ISO 9000

Fortunately, the standard to be used for the Worldwide Warehouse supplier certification effort may not need to be designed from scratch. The ISO 9000 series may be the answer. Originally published in 1987, ISO 9000 is rapidly becoming accepted as a worldwide standard for quality. Although it is typically identified as ISO 9000, this standard is actually a collection of five related quality standards, designated ISO 9000, 9001, 9002, 9003, and 9004 (Eckstein and Balakrishnan, 1993:66). As shown by Table 1, these five standards emphasize different aspects of quality. It should be noted, however, that the International Organization for Standardization does not intend the ISO 9000 series to "standardize quality systems implemented by organizations" (1987:1). To the contrary, Henkoff points out that the "governing principles can be summed up in three words--documentation, documentation, documentation" (1993:117).

Companies that choose to be certified must select the appropriate level of

Table 1. ISO 9000 Components (International Organization for Standardization, 1987:1)

Designation	Title	Meaning
ISO 9000	Quality Management and Quality Assurance Standards--Guidelines for their Selection and Use	Provides an overview of the entire series
ISO 9001	Quality Systems--Model for Quality Assurance in Design/Development, Production, Installation and Servicing	Includes everything in ISO 9002 and 9003 plus guidelines on design and servicing
ISO 9002	Quality Systems--Model for Quality Assurance in Production and Installation	Strong emphasis on production processes
ISO 9003	Quality Systems--Model for Quality Assurance in Final Inspection and Test	Only addresses problems associated with inspection and testing
ISO 9004	Quality Management and Quality System Elements--Guidelines	Helps a company develop and implement an internal quality system or evaluate an existing one

certification based on client, competitive or regulatory requirements (Eckstein and Balakrishnan, 1993:68). The International Organization for Standardization instructs that "After . . . [ISO 9000] has been consulted, the purchaser and supplier should refer to *ISO 9001*, *ISO 9002*, and *ISO 9003* to determine which of these International Standards is most relevant to the contract, and what specific adaptations, if any, have to be made" (1987:3). Firms which do not design the products they produce, for example, are not required to use a "full service" standard such as ISO 9001. In such cases, either ISO 9002 or 9003 would be a superior choice. Because of this flexibility, ISO 9000 has been successfully implemented in a wide array of industries.

ISO 9000 is the brainchild of the European Community (EC). Eckstein and Balakrishnan point out that the standards are basically a rewrite of the British standard BS5750 (1993:66). Due to its European roots, ISO 9000 is still much more prominent there than anywhere else. More than thirteen times as many British companies as American have already become certified (Henkoff, 1993:117). As a result of marketplace pressures, however, companies worldwide are rapidly catching up to their European counterparts in certifications. Firms in countries as diverse as Russia, Argentina, Japan, and Saudi Arabia are all pursuing certification. Recently, American industries have become especially aggressive in pursuing the ISO 9000 label. Pressure to become certified is increasing greatly in many industries, as customers have begun demanding their suppliers meet the standard. On another front, firms are

also receiving pressure from political entities such as the EC, which now virtually shuts out non-certified agencies (Eckstein and Balakrishnan, 1993:66).

Even with many companies and nations clamoring to get on board, there are problems that must be resolved. The pros and cons of these standards are important when considering whether or not they are applicable to any given situation.

The intent of the ISO 9000 series is simply to force companies to clearly specify their quality assurance procedures and ensure that they follow those procedures. Even with so simple an objective, however, implementation of the standard can yield powerful results. As explained by Rabbitt and Bergh in The ISO 9000 Book, "You won't be successful if your people don't know their roles and the system remains undefined. ISO 9000 compliance addresses the success of your organization because it addresses these two factors" (Rabbit and Bergh, 1993:58).

The benefits of ISO 9000, therefore, stem from its requirement that a business not only define, but actually understand the procedures relevant to the quality of its products. At a time when quality is so closely associated with market share, it is no wonder many businesses are scrambling to establish a strong quality program. ISO 9000 is an excellent tool for this end, because as Cynthia Robertson, a quality assurance specialist for the Air Force Materiel Command (AFMC) noted, "ISO 9000's value is that it offers the *foundation* upon which you can build a quality program" (Robertson, 1994).

Although ISO 9000 can go a long way toward establishing better quality, however, it is not a panacea. After all, even when companies have the best of processes in place there is still room for error, especially in complex environments. Eckstein and Balakrishnan reiterate that "[ISO 9000] is not a code of excellence. It is not total quality management (TQM). It does not guarantee a company's product quality, either" (1993:67). Taking the argument to the extreme, Motorola's director of corporate quality, Richard Buetow, recently underscored this point by complaining:

With ISO 9000 you can still have terrible processes and products. You can certify the manufacturer that makes life jackets from concrete, as long as those jackets are made according to the documented procedures and the company provides the next of kin with instructions on how to complain about defects. That's absurd. (Henkoff, 1993:117)

Despite this lack of a product quality guarantee, when an organization achieves ISO 9000 certification and claims to have implemented a total quality management philosophy, the certification is supposed to be a global measuring stick with which to gain confidence about the company's quality system. This measuring stick and the inspections which lead to certification have resulted in many benefits for the companies involved: "Among the measurable benefits companies have realized from adhering to the ISO 9000 standards are lower scrap costs, fewer rejects, and better on-time delivery" (Vaienti, 1993:42). Korane claims that ISO 9000 certification almost eliminates "the quality audits global customers normally require" (1993:74), saving the customer and the company money and time. The main reason many companies achieved

certification in the first place was to maintain access to markets where governments require certification in order to sell certain products. However, many large international industries are also beginning to require that suppliers meet the standards (Eckstein and Balakrishnan, 1993:66).

Even though many companies have realized huge benefits from meeting the ISO 9000 level of excellence, many others see little value added from meeting the standards. Because the standards are so general in nature, there is confusion and ambiguity in interpretation among the auditors who certify companies. This lack of common interpretation denies the opportunity for mutual global trust among accreditation agencies. "No one registrar is accepted worldwide," complain Eckstein and Balakrishnan. ". . . each nation has its own accrediting body and its own set of registrars, with none of the accrediting bodies recognizing each other" (1993:68). Although clarification of the standard is now underway by regional agencies, differences between regions will remain for the foreseeable future (Morrow, 1993:26).

Another primary factor which denies mutual recognition is a lack of accreditation requirements. Auditing firms which issue certificates for meeting the standards have no minimum accreditation requirements (Henkoff, 1993:117). Therefore, in some instances identical cases may be graded differently by separate auditors. This lack of standardized interpretation and accreditation will continue to hinder progress toward global implementation of this standard. Until

common interpretation is attained, a unified global understanding of certification cannot be achieved.

The certification process for companies is usually a difficult one. To become certified companies undergo a rigorous procedure whereby their quality processes are audited by an accredited third party. Documentation of the quality processes is absolutely critical, and workers are interviewed to ensure they understand exactly what is expected (Korane, 1993:76).

ISO 9000 mandates documentation coverage in 20 separate areas called elements. Reflective of the differing degrees of coverage provided by the various ISO 9000 standards, some of these elements are progressively relaxed even to the point of not being considered when moving from ISO 9001 down to ISO 9003. Table 2 associates these elements with their appropriate ISO 9000 standards. It should be noted that each higher level of the standard includes all of the elements in the lower levels preceding it (i.e., ISO 9001 necessarily includes 9002 which necessarily includes 9003).

Because the twenty ISO 9000 elements cover such a diverse range of organizational functions, the certification audit is normally a grueling experience. Spending up to three weeks in its examination, the typical audit team touches practically every element of operation. Upon arrival, the team's first concern is to examine internal inspection records. These records demonstrate trends and point out unresolved problems. If these problems are critical, the audit could end before it has even begun (Rabbitt and Bergh, 1993:112-113).

Finding everything in order, however, the auditors now fan out to begin an in-depth search of virtually every work section. Workers are interviewed to determine their competence in job performance and corrective actions as well as their knowledge of the company quality policy (Rabbitt and Bergh, 1993:114).

Table 2. ISO 9000 Audited Quality Elements (Breitenberg, 1992:3)

Audited Quality Elements	9001	9002	9003
1. Management Responsibility	X	X*	X**
2. Quality System	X	X	X**
3. Contract Review	X	X	
4. Design Control	X		
5. Document Control	X	X	X**
6. Purchasing	X	X	
7. Purchaser Supplied Product	X	X	
8. Product Identification & Traceability	X	X	X**
9. Process Control	X	X	
10. Inspection & Testing	X	X	X**
11. Inspection, Measuring, & Test Equipment	X	X	X**
12. Inspection & Test Status	X	X	X**
13. Control of Nonconforming Product	X	X	X**
14. Corrective Action	X	X	
15. Handling, Storage, Packaging, & Delivery	X	X	X**
16. Quality Records	X	X	X**
17. Internal Quality Audits	X	X*	
18. Training	X	X*	X**
19. Servicing	X		
20. Statistical Techniques	X	X	X**

\* Requirements are less stringent than those in ISO 9001

\*\* Requirements are less stringent than those in ISO 9002

The primary concern of the auditors, however, is the firm's documentation. This documentation is reviewed to ensure it correctly and completely defines every aspect of the organization's quality system. Among the policy documentation deemed essential for certification are such items as a quality policy and objectives, a quality manual, work instructions, corrective actions, and

internal quality audits. Supporting this documentation, system records such as management reviews, audit reports, and training records are meticulously examined (Rabbitt and Bergh, 1993:89). Highlighting the difficulties of meeting these documentation requirements, Det Norske Veritas, a large auditing firm, notes that of all twenty ISO 9000 elements, documentation accounts for more deficiencies than any other. In fact, the number of deficiencies noted in the area of documentation is fully fifty percent greater than the next most deficient element (Rabbitt and Bergh, 1993:111).

Provided the audited company has lived up to the high quality standards of ISO 9000, and its deficiencies are either minor or nonexistent, certification can be expected. This, however, is not the end of the road. The company should expect that the auditors "will be back every six months . . . to perform another shorter but more rigorous and in-depth audit focused on a specific operation" (Rabbitt and Bergh, 1993:118). Passing these semi-annual audits is required to maintain ISO 9000 certification.

According to Eckstein and Balakrishnan, the cost of achieving and maintaining this certification is no small factor. Prices for initial certification range from \$10,000 to \$200,000 depending on a company's size and level of certification. Additional costs are incurred for the follow-up audits required every six months (Eckstein and Balakrishnan, 1993:69).

Notwithstanding the difficulty and cost of achieving ISO 9000 certification, its implementation has shown major benefits to those companies which persevere

on the tough road to certification. Keeping international markets open and improving business practices has made ISO 9000 more than a fad. The list of countries which have adopted ISO 9000 is growing: the European Community, Austria, the Czech Republic, Slovakia, Hungary, Poland, Romania, Russia, Japan, Malaysia, Singapore, South Korea, Argentina, Brazil, Chile, Colombia, Tunisia, and Zimbabwe have all embraced the standard. Valenti believes that many others are working toward accepting the standard in the near future (1993:46).

#### NATO's SHARE Initiative

In the early 1970's, logistics managers of the North Atlantic Treaty Organization (NATO) noted the gains which could be realized through redistributing excess materiel instead of making new purchases. Thus, the NATO Maintenance and Supply Organization (NAMSO) published NAMSO Directive 222 which established the procedures for redistribution of excess stocks between NATO member nations. Although the logic of this program seemed unquestionable, its use in the days of large defense budgets was limited (Russell, 1994).

Today, however, defense budgets are shrinking worldwide. The NATO Maintenance and Supply Agency (NAMSA), managers of purchasing and redistribution for NAMSO, has initiated a revival and improvement of the original redistribution concept. The initiative is known as the Stock Holding and Asset Requirements Exchange (SHARE). SHARE aims to use new technology to

provide a service "that exploits existing materiel resources to the benefit of the customers" (NATO Maintenance and Supply Agency, undated:2).

SHARE is planned to be an electronic logistics stock exchange. The heart and soul of the stock exchange will be a computer-based catalog. NATO member nations who subscribe to SHARE will be both potential buyers and sellers. Subscribers, connected on-line with the catalog, will report assets available for redistribution. A query capability will also allow them to search the catalog and place requisitions for needed items (NATO Maintenance and Supply Organization, 1994:3-4).

The SHARE initiative is dramatically similar to the Worldwide Warehouse. Both aim to redistribute excess materiel for the benefit of allies. Both intend to catalog these excesses in order to make shopping easier. Only SHARE, however, has a precedent for proven quality control procedures whereby a middleman can effectively execute the transfer of materiel between two parties.

#### Conclusion

The build-up in excess inventories among US FMS customers presents problems for all parties involved. AFSAC's solution, the Worldwide Warehouse, offers a realistic opportunity to resolve these problems, yet quality assurance remains a roadblock.

ISO 9000, an up and coming standard in the world's business community, may offer a viable solution. The question, then, is whether or not this new standard should or could be employed by the Worldwide Warehouse. An

examination of SHARE's application of ISO 9000 in its quality assurance program should go a long way toward answering this question. Chapter Three explains how this question, along with the questions and research objectives mentioned in Chapter One, will be investigated.

### III. Methodology

#### Chapter Overview

This chapter addresses the research methodology used in this study by examining the research design and the two data collection methods employed: the literature review and the experience survey. Following this examination, this thesis explores how these methods are used to answer the six research questions posed in Chapter One.

#### Research Design

With the assistance of the thesis findings in Chapter Five, AFSAC will build the final quality control procedures for the Worldwide Warehouse. To accomplish this purpose, AFSAC will specifically need insight into the research questions identified in Chapter One. The goal of this thesis, then, is to provide a realistic view of whether or not the benefits of incorporating ISO 9000 into a supplier certification scheme are worth the costs that will be encountered.

Because the Worldwide Warehouse is a rapidly changing program which has not yet begun operation, no hard data are available concerning its performance. The approach of this thesis, therefore, is necessarily qualitative rather than quantitative.

For this project, an exploratory study offers the appropriate research design. Indeed, the Worldwide Warehouse and ISO 9000, the two entities crucial to this study, are both untested quantities as far as US government experience goes. AFSAC, after all, has so far only conceptualized the Worldwide Warehouse, and

admittedly possesses only cursory knowledge of the relatively new ISO 9000 standards. A close examination of these entities is necessary, therefore, if AFSAC's understanding of their relationship is to be advanced.

In such an uncertain environment, an exploratory study is necessary. As noted by Emory and Cooper, exploratory studies help "develop the concepts more clearly, establish priorities, and in many other ways improve the final research design" (1991:144). This final research design, it should be noted, is AFSAC's assumption of the next research stage, the development of the final quality control procedures for the Worldwide Warehouse.

AFSAC may also benefit in other ways from an exploratory study. According to Emory and Cooper, "Exploration may also save time and money if [the researchers] decide, after study, that the problem is not as important as first thought" (1991:144). This could avoid the problems associated with attempting to implement ISO 9000 if this study identifies that such implementation is infeasible.

#### Research Parameters

Consistent with its exploratory nature, this study is bounded by parameters commonly used in business research. The commercial nature of foreign military sales makes such a business approach desirable. Relying on this business link, the topical scope, time dimension, research environment, and method of data collection are easily determined.

Because examining a broader range of information aids in the development of budding concepts, the topical scope used in this study is aimed at breadth rather than depth of information. Indeed, such an approach is especially relevant to studies such as this where the problem is not yet fully crystallized, and the concepts need to be more fully developed.

Owing to the constraints of time and budget, the time dimension of this study is necessarily cross-sectional. As noted by Emory and Cooper, "Cross-sectional studies are carried out once and represent a 'snapshot' of one point in time" (1991:140). Since any major changes in ISO 9000 or its worldwide acceptance would require an international consensus, these changes will likely occur only at an extremely sluggish pace. Therefore, even with this snapshot, the findings should still be valid for the foreseeable future.

As is the case with almost every exploratory study, the research environment selected is a field setting. The alternative, the laboratory study, is infeasible for this thesis. In order to conduct a successful laboratory study, a vast amount of control is required over the key variables. In the case of ISO 9000, these variables are too ill-defined and uncontrollable. Regardless of this lack of control, the field study is used in this case to more clearly define the issues surrounding ISO 9000 and its applicability to the Worldwide Warehouse.

Monitoring, one of the two possible methods for collecting data in field studies, is not practical for the same reasons identified in the previous paragraph. Therefore, within this field study, data is collected via an

interrogative process. The vehicle for conducting this process is the experience survey. Experience surveys are likely the most valuable tool available for a successful exploratory study. Emphasizing this point, Emory and Cooper explain that:

While published data are a valuable resource, seldom is more than a fraction of the existing knowledge in a field put into writing. Then, too, even if more is published, it may be difficult to find. Thus, we will profit by seeking information from persons experienced in the area of study. Such persons can help us secure an insight into relationships between variables. To get an accurate picture of the current situation, we need to solicit the views of those believed to know what is going on. (1991:145-6)

### Data Collection

Three main parties have the special insight necessary to provide essential information for this thesis: AFSAC, NAMSA, and the Royal Norwegian Air Force (RNOAF). Senior leaders, program managers, and quality control personnel in each of these organizations were interviewed because they have likely experienced many of the aspects being investigated in this study.

AFSAC, located at Wright-Patterson Air Force Base in Ohio, is the owner of the Worldwide Warehouse. As such, AFSAC personnel possess the knowledge necessary for describing the mechanics of Worldwide Warehouse operations. Another important party, the NATO Maintenance and Supply Agency (NAMSA), is located in Capellen, Grand Duchy of Luxembourg. Its experience makes it a likely source of valuable information. As stated in Chapter Two, NAMSA has been effectively executing the transfer of materiel between two parties as a middleman for years. Furthermore, the quality control procedures they currently

employ in the transfer process rely heavily on ISO 9000. Finally, the RNOAF completes the study. Within the RNOAF, the Materiel Command is the Worldwide Warehouse focal point. Materiel Command headquarters is located in Kjeller, Norway. Current plans are for the RNOAF to be the first suppliers in a Worldwide Warehouse prototype test. This role as a key, initial player, coupled with its recent efforts to attain ISO 9000 certification provides insight into a participating country's perspective.

To carry out these experience surveys, personal interviews were conducted with managers and/or quality assurance personnel at each of the above locations (see Appendix B for a specific list of interviewed personnel). The purpose of these interviews was to identify the important issues or aspects of the problem as seen by these personnel.

Rather than adhering strictly to a set of prepared questions, interviews were conducted using a structured format. Under such a format, a set of questions is used only as a guide for discussion. Accordingly, the interview remains flexible enough to explore the various topics that emerge during the interview. This flexibility is the key to the success of this exploratory design (see Appendix C for the interview questions used at each location).

Prior to conducting this field study, the literature review found in Chapter Two was necessary. This review provided not only an excellent background into the published data surrounding this thesis, but also answered several of the

questions posed in Chapter One. The background provided by this review is the starting point from which the interviews described above are conducted.

### Analysis

As stated earlier in this chapter, an exploratory study is used to shed light on areas previously not understood. Based upon the data collected, then, answers to the individual research questions are reported in Chapter Four. These answers are then specifically related to the Worldwide Warehouse in order to facilitate analysis of the overall implications of ISO 9000 to quality assurance. This analysis is conducted by linking the experiences of those interviewed with the common sense of the authors so that logical connections can be made. Finally, the logical connections made from individual research question analysis will be integrated in Chapter Five. This integration should shed light on the issues important to establishing Worldwide Warehouse quality assurance procedures on ISO 9000.

### Conclusion

The imprecise nature of the quality control issues surrounding the Worldwide Warehouse are best answered through an exploratory study. This chapter presented the parameters for this study, the data collection methods used, and the means by which the collected data will be analyzed. In the next chapter, the research results are disclosed.

## IV. Research Findings

### Chapter Overview

Following the methodology outlined in the previous chapter, experience surveys were conducted during site visits to AFSAC, NAMSA, and the RNOAF Air Materiel Command. The data obtained on these visits, coupled with the literature review presented in Chapter Two, provide the answers necessary to ascertain ISO 9000's applicability to the Worldwide Warehouse. Organized by research objectives, this chapter explores this applicability through a step by step resolution of each research question.

### Research Objectives

#### Objective One

The first research objective identified in Chapter One requires an assessment of the ramifications of placing ISO 9000 at the core of a quality program. As shown in Chapter Two, these ramifications center on the harmonization of three themes: international interpretation, accreditation procedures, and recognition of certifications.

On the subject of international interpretation, the specific research question asks, "Is ISO 9000 interpreted identically by all agencies worldwide?" In short, nearly all published information pointed to the fact that this is not the case. As Chapter Two notes, the general nature of the standards produces confusion and ambiguity in interpretation among international auditing agencies. Even while

efforts are currently underway to improve this situation, Morrow points out that this deficiency is not likely to be resolved in the near future (1993:26).

The next research question deals with the issue of accreditation procedures. Specifically, it queries, "Are ISO 9000 accreditation procedures standardized?" Again, a negative answer is found in Chapter Two. Henkoff notes that no minimum requirements exist for accrediting international auditing firms (1993:117). Accredited auditors may exhibit different levels of competence, leaving open the possibility of different grades being awarded to the same firm by separate auditors. For this reason, many British firms require foreign suppliers to be certified by auditing agencies which receive accreditation through the British standards agency (Korane, 1993:76). Such an example clearly reflects the lack of worldwide accreditation standards for ISO 9000.

The final research question dealing with ISO 9000's political implications asks, "Do all nations recognize the certifications granted by accreditation agencies outside their borders?" Based on the answers to the previous two research questions, the reader can likely deduce the answer himself. With no standard interpretation or accreditation procedures, how can it be expected that nations mutually recognize the certifications granted by others? In any case, the literature review provides the decidedly negative answer. As Eckstein and Balakrishnan reiterated in Chapter Two, "No one registrar is accepted worldwide. . . each nation has its own accrediting body and its own set of

registrars, with none of the accrediting bodies recognizing each other" (1993:68).

This absence of mutual global trust in ISO 9000's implementation does not appear to bode well for the standard's inclusion in Worldwide Warehouse quality control procedures. One fear causing concern to AFSAC planners is that some nations may receive worthless quality certifications. This worthlessness could result for any number of reasons. For example, even while a justifiable certification might be granted in an underdeveloped nation, it may not be accepted by the more experienced European nations. Conversely, these European nations might accept a certification granted by auditors who do not understand even the minimum about ISO 9000. Attesting to this concern, quality control personnel at the RNOAF Air Materiel Command indicated wariness about relying on the quality of parts provided by underdeveloped countries based solely on a foreign ISO 9000 certification (Nyborg, 1994).

Although the lack of standardization demonstrated by the above discussion illustrates a significant shortfall of the ISO 9000 series, it is still possible for the standard to have usefulness in an international environment. After all, large companies are increasingly relying on the standard to help police quality even among their many international suppliers. In such cases, companies can overcome ISO 9000's lack of standardization by mandating that these suppliers receive certification from an auditor accredited by a specific agency. This greatly diminishes the standard's interpretation difficulties.

Because its suppliers also hail from around the globe, the Worldwide Warehouse could benefit from a similar approach. Under such circumstances, AFSAC could mandate that only government depot certifications obtained through a particular accreditor or auditor be employed. Because making such restrictions would reduce the roles auditors in many countries could play, however, this choice might be politically difficult to implement. Even so, such action is necessary if the ramifications of placing ISO 9000 at the core of the Worldwide Warehouse quality program are to be minimized.

#### Objective Two

The next objective explores the ability of ISO 9000 to ensure quality products. More clearly focusing this objective, the specific research question asks, "Can ISO certification ensure quality in and of itself?"

Before beginning an assessment of this question, a closer look should first be taken of ISO 9000's potential use in the Worldwide Warehouse. As discussed in Chapter Two, ISO standards 9001, 9002, and 9003 comprise the set of possible choices for certification. Among these possibilities, only ISO 9002 and 9003 appear to be suitable for the Worldwide Warehouse.

ISO 9001, in contrast, is not applicable due to its coverage in the unneeded areas of design control and servicing. Design control, as its name implies, relates to the design of products from concept through initial production. Because Worldwide Warehouse subscribers will only be providing materiel which was previously sold through US FMS, everything offered will have already

been "designed"; thus, this element is not applicable (Rabbitt and Bergh, 1993:122-123). The other irrelevant element, from the Worldwide Warehouse point of view, is servicing. The term "servicing", as it is used in ISO 9001, is a bit deceiving. It refers to services provided by the manufacturer to the purchaser throughout the life of the product sold. Since the manufacturing origin of all items within the Worldwide Warehouse is the US, America is the only supplier to whom servicing applies. The FMS customers who sell materiel in the Worldwide Warehouse will certainly not be providing service to the purchasing nation after the sale. Thus, when applied to Worldwide Warehouse subscribers, "servicing" is not an essential element (Rabbitt and Bergh, 1993:134).

With its coverage of the inspection and test process, ISO 9003 provides a minimum standard. This minimum standard should ideally only be applied to those nations which have little internal depot repair capability. For ISO 9003 to work well for the Worldwide Warehouse, these nations should primarily "warehouse" materiel, sending repairable items back to the United States for repairs. Supplying nations registered to this level, after all, have demonstrated only that they are capable of inspecting and testing the parts they supply. Therefore, even if a nation rarely performs major repairs, it will still be capable of knowing which of parts have been repaired correctly. These parts could satisfactorily be accepted by the Worldwide Warehouse.

In most instances, however, ISO 9002 provides a superior alternative for a supplying country. Because this standard encompasses all aspects of ISO 9003

and then adds the processes of production and installation, nations registered to this level would see process improvements across the entire range of depot operations which effect FMS-purchased parts. When linked with the technical orders for a part, then, this standard could go a long way toward increasing the quality of items offered to the Worldwide Warehouse. This improved quality would cover not only the warehoused consumables and US-repaired items, but it would also practically ensure high quality for items repaired in the subscriber's own depots.

With ISO 9000's potential Worldwide Warehouse form now outlined, discussion of the second objective can commence. The literature review once again provides a good starting point. In essence, while virtually all published knowledge on ISO 9000 touts the benefits to be gained through its implementation, most quality control experts agree this standard is not the panacea for product defects. While product defects frequently decrease after ISO 9000's implementation, this cannot wholly be attributed to the standard. After all, the goal of ISO 9000 is merely to ensure *consistency in the process*, not quality in the product.

ISO 9000's success in eliminating product defects can best be judged by the clarity, correctness, and completeness of its companion specifications. As alluded to earlier, the required Worldwide Warehouse specifications are storage and repair specifications (i.e. technical orders). When used in conjunction with

such specifications, ISO 9000 most often results in a lower level of product defects.

The attempt of the RNOAF depot at Kjeller to achieve ISO 9000 certification shed further light on this necessary marriage of ISO standards with strict specifications. During a site visit to Kjeller, the chief engineer, Mr. Paul Paulsen, explained that during this two-year attempt, quality had significantly improved. He indicated that this improvement would not have been possible, regardless of ISO 9000's benefits, had strict technical order "specifications" not already been an integral part of their current processes (Paulsen, Martinsen, and Westby, 1994).

Anchored by those strong specifications, the depot's processes were then poised to fully capture the benefits of ISO 9000. Paulsen believed Norway's road to quality improvement was paved by the standard's stringent documentation requirements. Like a row of dominoes toppling one after another, benefits began to be felt throughout the entire organization. Stricter "process" documentation required a better understanding of internal customer needs (Paulsen, Martinsen, and Westby, 1994).

Armed with this clearer picture, workers began removing the gaps in the process. This streamlining, coupled with the increased documentation, provided traceability, the key to all improvements. Employing this new ability in conjunction with their already good set of specifications, workers traced many

problems to previously unsuspected root causes. As a result, repairs were more consistently performed without defect (Paulsen, Martinsen, and Westby, 1994).

Warehousing and repair specifications are included in most FMS purchase agreements. Since these specifications are generally considered clear, correct, and complete, it must be concluded that if an appropriate ISO 9000 standard could be implemented, high product quality would be virtually assured. The key word, however, is "if". As indicated by the Norwegian example above, even nations who have strict specifications integrated into their logistics processes often experience difficulty in achieving certification. The potential problems this poses for the Worldwide Warehouse are more fully explored in Chapter Five.

### Objective Three

The final objective of this thesis is to study SHARE's implementation of ISO 9000 in its quality control procedures. The first research question queries, "Does SHARE sufficiently resemble the Worldwide Warehouse such that useful comparisons might be made?"

As Chapter Two revealed, the SHARE initiative is dramatically similar to the Worldwide Warehouse. These programs were both initiated to solve excess inventory problems for the benefit of allies. They each intend to catalog these excesses to provide a new resource to buyers and sellers. Buyers have an additional source of supply, thus creating the possibility of shorter lead times and lower inventory requirements. Sellers can rid themselves of excess inventory and its associated holding cost, freeing both space and cash for

additional purchases. Both programs employ a fee-for-service structure, in which buyers and sellers are each required to pay 5% of the transaction value to cover program operating costs.

Notwithstanding their many similarities, SHARE and the Worldwide Warehouse also have two differences. The first of these differences involves their respective constituencies. Confined to NATO, SHARE's subscribers have a long history of military cooperation. In contrast, the only common thread among Worldwide Warehouse subscribers is their link to the United States.

Differentiating these constituencies further is the perceived inconsistency of quality between individual nations; SHARE's subscribers are generally seen as having a more consistently high quality than those of the Worldwide Warehouse. Several reasons exist for this apparent chasm. SHARE's subscribers, the members of NATO, clearly possess some of the most industrialized economies, best funded militaries, and most educated workforces, in the world. It is no coincidence that these nations are home to some of the globe's most quality-minded organizations. Many of the countries which will subscribe to the Worldwide Warehouse, in contrast, are far less fortunate. Indeed, it seems unreasonable to expect a high degree of quality from those undeveloped nations where even literacy is not common. It is reasonable to assume, therefore, that these subscribers as a whole employ inferior quality control procedures when compared to those of SHARE.

The second difference is the primary reason SHARE was chosen as a source of information for this thesis. Unlike the Worldwide Warehouse, SHARE's predecessor, the NATO Coordinated Aircraft Parts Brokerage and Redistribution Program, has been managing the transfer of excess materiel between foreign nations since 1974. This experience as a middleman has resulted in a successful set of quality control procedures.

Overall, SHARE and the Worldwide Warehouse bear an uncanny resemblance to each other. If, while reading the documentation on either of these two programs, the subscribers' identities were concealed and the quality control procedures were omitted, one would not be able to discern which program was being discussed. Although there are differences in constituencies, they should not so detract from the similarities as to make a comparison invalid. Far from being a hindrance, the second difference relating to NAMSA's experience as a middleman provides an avenue for useful information. This avenue leads to a successful set of quality control procedures.

An evaluation of these procedures should be beneficial to the Worldwide Warehouse. Pursuing this evaluation, the second research question asks, "How is ISO 9000 employed in SHARE's current quality assurance procedures?"

According to the most recent draft of the NAMSO Functional Directive 223, SHARE will employ the proven procedures employed in the Coordinated Aircraft Parts Brokerage and Redistribution Program (NATO Maintenance and Supply Organization, 1994:5). This program, operated by NAMSA, handles the

requisitioning and shipping of materiel from one NATO country to another. Directive 223 states that "It is the responsibility of the NAMSO member countries to guarantee that the materiel assets offered by authorized users have been manufactured using NATO or NATO member country national quality standards" (NATO Maintenance and Supply Organization, 1994:5). Manufactured in this sense refers to all aspects of manufacturing throughout the life-cycle of parts (e.g. production and future repairs). Although notable exceptions (e.g. The United States and France) exist, these standards all have ISO 9000 at their core (Grenier, 1994). In addition to these standards, the quality of the parts is ensured only by a visual inspection of the materiel condition, packaging, and documentation. No attempt is made to functionally check equipment. Unless obvious defects are noted during the visual inspection, materiel is shipped to the purchaser. Any problems with quality after customer receipt are taken care of via discrepancy reports (Russell, 1994).

### Conclusion

In this chapter we found that there is no mutual, global understanding of the ISO 9000 series of standards. Despite this lack of understanding, ISO 9000 should be able to ensure product quality for parts offered to the Worldwide Warehouse. Finally, SHARE's relevance to the Worldwide Warehouse was established and its quality assurance procedures were explained. Chapter Five will assess the implications of ISO 9000's many facets and the applicability of SHARE's quality control procedures to the Worldwide Warehouse.

## V. Conclusions and Recommendations

### Chapter Overview

The purpose of this chapter is to briefly summarize the goals of this thesis and present its conclusions. Following this assessment, recommendations for establishing the quality control procedures of the Worldwide Warehouse are offered. Finally, several ideas for further research are volunteered which may, if explored, assist in Worldwide Warehouse development.

### Summary of Research

The goal of this thesis was to evaluate ISO 9000's applicability to the Worldwide Warehouse. To do so, the subsequent research required the pursuit of three main objectives: (1) assess the ramifications of placing ISO 9000 at the core of a quality control program, (2) ascertain whether or not ISO 9000 is capable of ensuring quality in and of itself, and (3) study SHARE's implementation of ISO 9000 in its quality control procedures. While a literature review proved to be quite helpful in fulfilling these objectives, a lack of printed material on the Worldwide Warehouse required the use of experience surveys via personal interviews to gather more detailed information.

A broad range of perspectives was captured during these interviews. At AFSAC, Worldwide Warehouse program managers offered their ideas about program implementation. This contact was essential not only for understanding the many facets of the program, but also for keeping abreast of its many changes. In Norway, personnel at the RNOAF Air Materiel Command presented the customers' viewpoint. Especially enlightening was their identification of the

link between ISO 9000 and product specifications. Without their ISO certification experience, this link might not have been clear. Finally, personnel from NAMSA were extensively interviewed regarding their vast experience with not only parts transfers, but also ISO 9000 itself. The discovery that not even all NATO member countries can agree on ISO 9000 played a key role in arriving at the following conclusions.

### Conclusions

Chapters Two and Four presented the objectives individually. This section considers these objectives collectively to form a logical argument which resolves the research problem. When considered in their totality, the research findings suggest that ISO 9000 would not work well at the core of the Worldwide Warehouse quality program.

This negative answer boils down to ISO 9000's design. Like the Constitution of the United States, ISO 9000 was intentionally designed to be both flexible and supported by more specific guidance. For both the Constitution and ISO 9000, this flexibility is necessary to ensure universal applicability across a myriad of situations. Because of the countless number of scenarios involved, however, implementing the ideals of these documents is impossible without more specific guidance. Sources of this guidance are varied. In the case of the Constitution, it is supported by the many laws and regulations of the land. ISO 9000, on the other hand, requires product specifications from the many industries of the world.

ISO 9000, therefore, often must be coupled with an inordinate amount of documentation. Fortunately for items sold through the US FMS program, purchasers need only the storage and repair specifications. These specifications, in the form of technical orders (TO), are normally transferred to the customer with each purchase. Even while customers may possess these TOs, however, questions still remain regarding the integration of the associated procedures into some customers' current logistics processes. For example, do maintenance technicians in the less industrialized nations make repairs using the TOs as a checklist at the aircraft? Or do they, after becoming "proficient" at the repairs, shelve the TOs in a technical publications library to collect dust? These questions, while arbitrary, serve to illustrate that the processes of some customers are likely to be conspicuously absent of the integration which more industrialized nations consider standard operating policy. Because ISO 9000 certification requires the reversal of such problems, it may be a useful tool for bettering the quality generated by such systems. Even so, turning around programs with such fundamental deficiencies can be extremely difficult, casting doubt upon the ability of some nations to attain certification, especially in the short term.

ISO 9000 certification, therefore, would likely take many Third World nations years to attain. Yet, even for more developed nations where high quality already exists, achieving ISO 9000 certification can still be a forbidding task. The RNOAF's Kjeller depot provides a good example. Despite the outstanding

quality of Norwegian maintenance, this depot has struggled with ISO 9000's process definition requirement for over two years. Because certification requires a thorough understanding not only of the individual processes involved, but also how their interaction affects the entire system, improvement has come only from painstaking effort. Despite their extensive commitment of resources to this problem, the depot has yet to receive certification. Their attempt attests to the fact that attaining certification even with outstanding quality can be very difficult. This casts further doubt about the ability of countries with poorer initial quality to complete the task.

Even if the previous points were not an issue, ISO 9000's design for universal applicability would still preclude its use. Normally, guidance which is designed for universal applicability requires an evolutionary phase. During this evolution, users implement the guidance and interact with others who are also implementing it. Through this interaction, disputes arise and are settled, resulting in generally accepted interpretations. This process is iterated many times, resulting in the maturation of the guidance.

Unfortunately, in the case of ISO 9000 such maturation has not yet occurred. Owing to the standards' short life, no generally accepted, global interpretations have yet evolved. NATO's absence of agreement on the implementation of this quality standard is a prime example. Yet, with an even larger number of nations slated to participate in the Worldwide Warehouse, a unified worldwide interpretation will be critical for success. Even if these concerns are allayed

through the dictatorial selection of one "approved" auditor as suggested in Chapter Four, the value added by requiring Worldwide Warehouse subscribers to achieve ISO certification seems minimal.

This value added argument is the final nail in ISO 9000's coffin. The entire argument is based on the fact that a relatively small number of items is expected to improve in quality as a result of ISO 9000 certification. This small target of opportunity is unlikely to generate savings in excess of the steep costs of imposing ISO 9000. The ensuing analysis identifies why this is the case.

To the Worldwide Warehouse, ISO 9000's worth would be validated each time it prevented a deficient part from being passed on to a buyer. Thus, if a large percentage of parts were expected to be deficient, the value of certification would seem to be great. Derailing this expectation, however, is the fact that all parts do not have an equal chance of being deficient.

Consumable items, for example, are unlikely to pose a threat to Worldwide Warehouse quality. Such items, by definition, are disposed of after use. Therefore, those consumable items which will be eligible for redistribution via the Worldwide Warehouse will necessarily be unused. Often still sealed in their original packages, these items should not be a quality issue. Since the US guaranteed the initial quality and the purchaser was only required to properly warehouse these items, little opportunity for quality degradation should have presented itself.

Although Chapter Two estimated that the inventories foreign governments have eligible for transfer through the Worldwide Warehouse are composed five percent of reparables and 95 percent of consumables, these figures may not accurately represent the proportions of items actually processed. In truth, consumable items will probably make up less than 95 percent of transferred parts.

Two reasons exist for this decreased showing. First, consumable items usually have a lower cost than reparables, making them less profitable to sell. After all, the money to be gained by selling an item such as a bolt will often be less than the cost of shipping it. Second, many nations may elect to hold onto their consumable items because they may still be valid in other systems. In any case, the percentage of consumables handled by the Worldwide Warehouse is likely to be somewhat lower than 95 percent. AFSAC currently has no estimate of this figure.

This logic should leave reparables accounting for a greater proportion of items offered to the Worldwide Warehouse. Yet, even among these remaining reparables, quality problems should not be a major concern in many cases. As noted by Orlando and Rhame in a 1992 thesis on the FMS pipeline, many countries use US depots exclusively for their repairs, particularly when their Air Force inventories are small. Moreover, even in cases where countries operate an in-house repair capability, they often still use US depots to supplement their own work (Orlando and Rhame, 1992:8). With many countries either totally

relying on or at least supplementing the maintenance of repairable items with US depot repairs, concern over the quality of such repairs is dramatically reduced.

After removing consumables and US depot-repaired items from the list of concerns, only a small percentage of the total number of parts eligible for transfer remain with questionable quality. These parts, repairable items repaired in-country, represent the major portion of transferred items which should account for the Worldwide Warehouse savings as a result of ISO 9000 implementation.

Based on the structure of the Worldwide Warehouse, only one area of potential savings seems likely: a reduction in the frequency and magnitude of Reports of Discrepancy (RODs). Because anonymity throughout the system is paramount in the minds of AFSAC policymakers, elimination of the IIP is not possible. Anonymity requires the removal of national markings, and an IIP seems to be the most efficient means to accomplish this task. Therefore, ISO 9000's savings should be seen primarily through a reduction in RODs across a small number of items.

Considering these savings, the value added to the Worldwide Warehouse process as a result of ISO 9000 is expected to be minimal. When weighed against the pain which is necessary to achieve certification, along with the confusion and uncertainty which surrounds the standard, one would be hard-pressed to say that the value added is worth the requisite costs. ISO 9000 and the Worldwide Warehouse are simply not ready for one another.

### Recommendations

Having reached the conclusion that ISO 9000 is not applicable to Worldwide Warehouse quality control, it is necessary to go beyond the scope of this thesis to assist AFSAC with the development of the final quality control procedures. Although the SHARE case study supported the negative answer to ISO 9000's applicability, it also provided the path for this recommendation.

Basically, visual inspections at the IIP with product defects sorted out via RODs filed by the purchaser should be the core of the initial Worldwide Warehouse quality assurance program. In this proposed system, it should be incumbent upon the buyer to conduct functional inspections, as needed. These are the procedures NAMSA now follows with great success.

Even while NAMSA has had success with its visual inspection program, the Worldwide Warehouse's broader constituency base requires an additional control. Since questions remain regarding the quality some subscribers are capable of providing, a "penalty box" limiting the participation of those suppliers who demonstrate a proclivity toward providing inferior parts should be implemented. This should keep the number of RODs to a bare minimum.

Customer support for the recommendation as outlined is likely to be significant. Indeed, Lt Col Nyborg, Head of the Materiel Management Branch at the Kjeller depot, embraced such an approach during an experience survey. Certainly, this strong support from the quality-minded Norwegians bodes well for this approach.

### Future Research

A logical follow-on to this study is the assumption of the next research stage, the development of the quality control procedures for the Worldwide Warehouse. However, with the program still in its infancy, many issues in addition to quality assurance remain unresolved. Three such issues deserving attention are:

1. Identify the percentage of reparables versus consumables which will actually flow through the Worldwide Warehouse, so that an appropriate quality control scheme can be designed.
2. Identify the excesses which really exist, and how many of those excesses could have filled current backorders.
3. Conduct a transportation analysis to determine the number and locations of intransit inspection points.
4. Conduct a cost/benefit analysis of contractor versus Air Force administration of Worldwide Warehouse operations.

Continued research in these areas should enhance the future level of support provided to US allies.

## Appendix A: Glossary of Terms

**ARMS TRANSFERS** - Defense articles and defense services, such as arms, ammunition, and implements of war, including components thereof, and the training, manufacturing licenses, technical assistance and technical data related thereto, provided by the US government under the Foreign Assistance Act of 1961, as amended, or the Arms Export and Control Act, as amended; other statutory authority; or directly by commercial firms to foreign countries, foreign private firms, or to international organizations.

**AIR FORCE SECURITY ASSISTANCE CENTER (AFSAC)** - The AFMC organization responsible for providing logistics support to FMS customers through the USAF security assistance program.

**CONSUMABLE** - Items that are typically consumed or used up beyond economical repair during their intended use. Common examples of consumables are paper and pencils, paint, nuts and bolts, and the myriad of bits and pieces used to repair broken end items. Consumables are generally inexpensive and form the bulk of items maintained in the supply system ("The Retail/Wholesale Supply System":7-2).

**FMS EXCESS MATERIEL RETURN** - An AFMC program through which materiel that was originally acquired by an FMS customer through an FMS program and is now excess to their needs may be returned to AFMC inventory to fill a specific USAF need.

**FOREIGN MILITARY SALES (FMS)** - That portion of US security assistance authorized by the Arms Export Control Act, as amended, and conducted on the basis of formal contracts or agreements between the US government and an authorized recipient government or international organization. FMS includes government-to-government sale of defense articles or defense services, from DOD stocks or through purchase under DOD-managed contracts, regardless of the source of financing.

**QUALITY ASSURANCE** - A planned and systematic pattern of all actions necessary to provide adequate confidence that adequate technical requirements are established, products and services conform to established technical requirements, and satisfactory performance is achieved.

**REPARABLE** - Items designed to be economically feasible for repair after failure. Examples include radios, radar sets, landing gear, and other high value items ("The Retail/Wholesale Supply System":7-2).

**REPORT OF DISCREPANCY (ROD)** - Standard Form (SF) 364 "Report of Discrepancy" used by a customer to report a discrepancy in an item or service supplied by the USAF; information required includes description of discrepancy, circumstances associated with it, and resolution recommendations.

**SECURITY ASSISTANCE** - A group of programs authorized by the Foreign Assistance Act of 1961, as amended, and the Arms Export Control Act of 1976, as amended, or other related statutes by which the US provides defense articles, military training, and other defense-related services, by grant, loan, credit, or cash sales in furtherance of national policies and objectives.

**THIRD PARTY TRANSFER** - Transfer of materiel of US origin from one FMS customer to another. These transfers are not FMS transactions. They are country-to-country agreements between the two customers involved. Third party transfers must be approved by the US Secretary of State.

**USAF TECHNICAL ORDER (TO)** - A manual developed for use by USAF activities in the operation and maintenance of USAF weapon systems and equipment.

Appendix B: List of Interviewed Personnel

AFSAC Personnel

Mr Richard Brusky, Worldwide Warehouse Program Manager, Air Force Security Assistance Center, Wright-Patterson Air Force Base, Ohio. 15 Oct 1993 - 1 Aug 1994.

NAMSA Personnel

Mr Serge Grenier, Quality Control Engineer, NAMSA Quality Assurance Division, NATO Maintenance and Supply Agency, Capellen, Luxembourg. 27 Jun 1994.

Mr Timothy B. Russell, Chief, Supply Branch, Special Projects Programme Office, NATO Maintenance and Supply Agency, Capellen, Luxembourg. 27 Jun 1994.

Royal Norwegian Air Force Personnel

Mr Frank Martinsen, Quality Inspector, Materiel Command, Royal Norwegian Air Force, Kjeller, Norway. 1 Jul 94.

Lt Col Almar Nyborg, Head of the Materiel Management Branch, Materiel Command, Royal Norwegian Air Force, Kjeller, Norway. 1 Jul 94.

Mr Paul Paulsen, Chief Quality Inspector, Materiel Command, Royal Norwegian Air Force, Kjeller, Norway. 1 Jul 94.

Mr Kare Westby, Quality Inspector, Materiel Command, Royal Norwegian Air  
Force, Kjeller, Norway. 1 Jul 94.

## Appendix C: List of Interview Questions

### AFSAC Questions

1. What is the Worldwide Warehouse concept?
2. What are the details concerning the planned Worldwide Warehouse operations?
3. What are the quality control issues which might impact Worldwide Warehouse operations?
4. What role do you envision ISO 9000 playing in Worldwide Warehouse quality control procedures?
5. Are there any programs currently in existence which are similar in concept to the Worldwide Warehouse?
6. Are there any future Worldwide Warehouse customers which, based on experience, might have insight into the pros and cons of ISO 9000?

### NAMSA Questions

1. How does SHARE compare to the Worldwide Warehouse?
2. Does ISO 9000 play a significant role in Functional Directive 222's quality assurance program?
3. What specific quality assurance procedures are employed by Functional Directive 222?
4. How important is ISO 9000 to these procedures?

Royal Norwegian Air Force Questions

1. Is your depot ISO 9000 certified?
2. What is involved in the preparation necessary to achieve ISO 9000?
3. Based on your understanding of the Worldwide Warehouse and ISO 9000, is it important to you that supplying nations achieve certification?
4. As a potential Worldwide Warehouse customer, what is your suggestion for its quality assurance procedures?
5. Is a visual inspection with problems sorted by reports of discrepancy a satisfactory solution for Worldwide Warehouse quality?

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Vita

Captain Anthony T. Dyess was born on 26 April 1967 in Orlando, Florida. He graduated from Forest Hill High School in Jackson, Mississippi in 1985 and then attended the United States Air Force Academy. Graduating in 1989 with a Bachelor of Science in International Affairs, he was assigned to the 1st Special Operations Wing at Hurlburt Field, Florida. Assigned as a logistics officer, he served as the Deputy Chief of the Logistics Plans and Programs Office. During this tour, he served five months as the Chief of Logistics Plans, Air Force Special Operations Command Central - Deployed at King Fahd Air Base, Kingdom of Saudi Arabia in support of Operations DESERT SHIELD/STORM. He entered the School of Logistics and Acquisition Management, Air Force Institute of Technology, in May 1993.

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Vita

Captain Henry E. E. Stish was born on 27 February 1966 in Allentown, Pennsylvania. He graduated from Blooming Prairie High School in Blooming Prairie, Minnesota in 1984 and then attended the United States Air Force Academy. Graduating in 1988 with a Bachelor of Science in International Affairs and a minor in Russian language, his initial assignment was to the 651st Combat Logistics Support Squadron, Kelly AFB, Texas. Assigned as a logistics officer, he worked there as the Chief of the Logistics and Training Branch until October of 1992. Following this job, he remained at Kelly AFB where he was then assigned to the Proven Aircraft Division of the Aircraft Directorate. Working there as a Program Integration Manager, he received six months of Foreign Military Sales exposure before being accepted to the Air Force Institute of Technology. He entered the School of Systems and Logistics, Air Force Institute of Technology, in May 1993.

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